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Experimental Investigation of Exhaust Temperature of Four stroke Diesel engine by using Multi walled Nano Tube as a coolant

Yatika Gori[1], Manish Kumar Lila[2]

[1]Department of Mechanical Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002
[2]Department of Mechanical Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002

ABSTRACT

The architecture of coolers as well as the grade of gasoline refrigerants have been continuously improved. Earlier fluid vehicle coolants encountered several challenges, including liquefying temperatures, chilling temperatures, as well as fundamentally poor thermal transmission. Furthermore, traditional coolants have surpassed their thermal transfer size restrictions. To replace conventional heat exchangers, novel heat conduction liquids were created and are being dubbed nanomaterials. Furthermore, various studies are being conducted on the use of nanofluids in order to reap their advantages. Throughout this research, 0.2, 0.4, and 0.6% volumetric percentages of multiple wall nanofibers/water nanomaterials were generated using two different processes with surfactants as well as utilised as a cooler in a single diesel fuel to determine the heating value. The produced nanoparticles are evaluated using a scan electron microscope to ensure homogenous distribution and nanotube durability using an ionic conductivity analyser. Experiments are carried out using two volumetric air flow rates of cooling nanofluid, like 230, 280 and 310 LPH, as well as varying the loading from 0 to 1800W while maintaining the engine power unchanged. If compared to cooling with water under the conditions, its output temperature falls approximately 11–16%.

Keywords: Diesel Engine; Nano Fluid; MWCNT; Exhaust Temperature; Performance Characteristics.

INTRODUCTION

A multiple gasoline engine's conditioning system is fundamental to its effectiveness. Its engines generate a significant amount of warmth that needs to be evacuated in order for it to operate efficiently. The latest existing thermostat employs freshwater as well as a generally pro-chemical as the fluid is for radiators to transfer the engine's hot air by fluid flow. Its coolant's heat exchange capability is insufficient to eliminate any additional energy created inside the engines [1]. Their usage of nanomaterials may enhance the volume of water of a coolant's temperature difference, hence improving the coolant's thermal efficiency. Therefore, the proportion of water nanofluid

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nanostructures required to best transport energy has to be calculated. Thermal transmission has an immediate impact on combustion characteristics, fuel economy, choice of materials, and emissions [2]. These same advantages of high temperature evaporators but rather heat transport gadgets utilising nanomaterials include: lowered mass, which also improves fuel efficiency; relatively small parts, that also take up less space underneath the mask as well as enable greater airflow latitudinal; extra efficient refrigeration, as well as enhanced tools that support Furthermore, coal mining will be reduced because fewer metals are needed, reducing environmental harm and conserving metal manufacturing. The capacity of evaporators reduces a substantial pollution problem now at the conclusion of their effective entire lifespan [3].

Water nanofluid micro cooling does have a high thermal transmission quality and speed, which includes heat transfer of nanofluid may be improved by upwards to 120% using nanoparticles. Numerous studies, mostly on the temperature characteristics of nanotube nanofluid, have been published and demonstrate a significant influence when relative to the base liquid, as described by Phillip in Hayashi. Its weight percentage in nanomaterials as well as the temperatures are the primary determinants of this improvement. Numerous studies found that adding carboxyl to hybrid nanofluid boosted their melting point by up to 401%. They further discovered that the heating rate of zirconium graphene offers sufficient potential to be employed in heat flux adding of $Fe2O3$ [4,5].

When the particle concentration is increased, heat transfer increases temperatures by 12% at 22 °C, 20% at 23 °C, and 61% at 30 °C. An earlier study found that the comparative heating rate of a nanotube base fluid is constant between temperatures of 16 and 62 °C. Such findings are consistent with those published by researchers. Velmurugan et al. studied the influence of surfactants, screen resolution of nanomaterials, as well as the existence of nanoscale clustering on the heat capacity of nanotube nanocomposites. Metallic compounds, cementite, and nanomaterials are common nanomaterials found in base fluids. According to the latest research, radiators that can handle a larger heat demand can lower the radiator's diameter by about 20%. Additionally, the drag force, gasoline pouring, and fan speed may all be lowered, culminating in a 15% efficiency gain. Hassan et al. examined the temperature characteristics of nano fluids embedded in automobile radiator water as well as discovered that a 1% catalyst loading above 40°C resulted in an 8.3% boost of nanofluids. Raj et al. looked into the behaviour of aluminium waters at various nanofluid percentages. Researchers found that even at 3 vol.% nano fluids, the higher thermal conductivity increment of heat transfer rate reached 20% [6,7].

It was discovered that little work was noted in implementing water nanofluid as a refrigerant in internal combustion engines. As nothing more than a result, in this work, multi-walled carbon nanotube nanomaterials are utilised as refrigerants in internal combustion engines, but instead tests are carried out to compare the effects of nanocomposite nanofluid on the heat release rate of exhaust emissions to liquid.

MATERIALS AND METHODS

2.1. Particulars of multi walled carbon Nano Fluids

The supplier provides nanotube characteristics, which are shown in table 1. Figure 1 depicts the SEM picture of the nanostructures being equally scattered in the base liquids. The heat transfer as

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well as permeability were calculated by using the following formulas.

TABLE 1. DETAILS OF MULTIWALLED NANO PARTICLES

Volume of Nano Particles	Heat Conductance	Viscosity
0.2	0.7892	1.3258x10-3
0.4	0.8623	1.4362x10-3
0.6	0.9214	1.5287x10-3

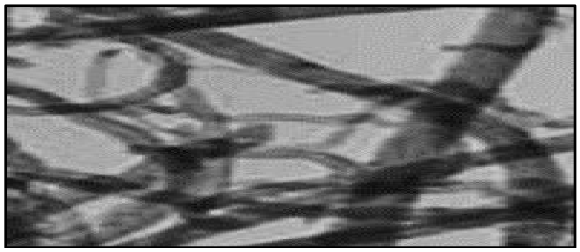

Fig.1. Microstructure Image of multi walled carbon Nano tube

2.2 Preparation of Nano Fluid

Production of nanofluids is the very first step in studying nanofluids experimentally. There are two primary ways for preparing nanofluids: separate preparations as well as multiple preparations. Only one method creates and diffuses nanomaterials immediately into conventional fluids. This method assures consistent dispersion and also no aggregation. The multiple process creates nanomaterials using one of the physical or biological manufacturing technologies and then disperses them in conventional fluids [8].

Throughout this study, nanomaterials were created by combining multi-walled carbon nanotube nanomaterials using filtered water as conventional fluids at volume fractions of nanoparticles of 0.2, 0.4, and 0.6% and by introducing a therapeutic concentration of potassium anhydride acetylene sulfonic. The aforementioned nanofluids were prepared in a two-step method. The needed volume of conventional fluids was initially put into a 1 litre plastic bottle and stirred in this investigation. water nanofluid values of 0.2, 0.4, and 0.6% vol. A reaction mixture was used to disseminate these solutions as well as concentrate them.

Figure 2 illustrates the homogenous mixtures produced following mechanical stirring. The reaction mixture uses an electromagnet to agitate the magnetised pellets submerged in liquid, causing them to rotate very fast and causing even physical mixing. An acoustic device that generates ultrasound waves of 38 W at 35 kHz also assures particulate scattering inside the coolant. Sonication is the use of acoustic pressure to stir molecules in liquid. Interruptions of this type can be utilised to combine situations, accelerate the dissolving of solids into vapour, and also eliminate absorbed gases from fluids. The nanomaterials are held in an ultrasonic bath for 4 hours at 30 °C to achieve a uniform dispersion and facilitate smoothness that dictates the final characteristics of the nanoparticles.

RESULTS AND DISCUSSION

3.1. Emission Conditions at mass flow rate 230 LPH

Figure 2 shows this because when 0.2, 0.4, and 0.6% volumetric concentrations of nanoparticles are

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used, the emission temperature goes up by 1-3%, 4-8%, and 2-6% as compared to the conventional method. That improvement is due to the influence of nanofluids in different volume concentrations. When compared to its peers, the emission pressure drops as the quantity of nanofluids increases. The load applied to the combustion planet warms. Furthermore, at 0.4% volume fractions, the highest emission thermal infrared range is attained. This happens because 0.4% nanomaterials are much more stable as well as preserve thermal resistance. Furthermore, 0.6% of nanomaterials exhibit poor stability because of nanotube clumping, which causes settling as well as reduces conductivity. Figure 2 shows the above findings [9].

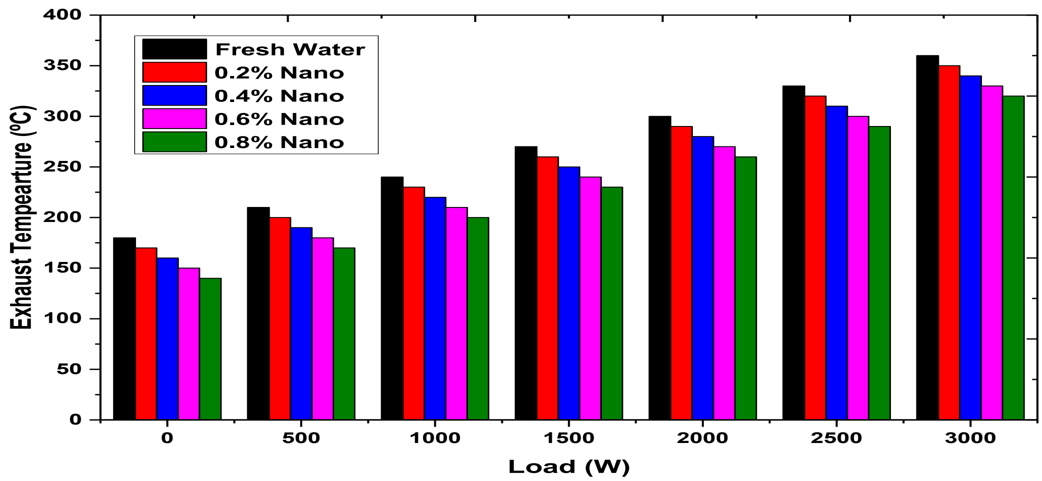

Fig.2. Exhaust temperature Vs Load under 230 LPH

3.2. Emission Conditions at mass flow rate 280 LPH

Figure 3 depicts the differences in weights changing heat release for liquids. Emission rates are reduced by 1–11%, 5–15%, and 3–14% when 0.2, 0.4, and 0.6% volume concentrations of nano liquid are used, correspondingly. Figure 9 shows a similar pattern, with the 0.4% nanocomposites exhibiting greater heat absorption than the 0.2% and 0.6% nanoparticles. That decrease is due to nanofluid having a greater thermal conductivity than freshwater and a better mass flow to transport greater energy. One explanation for the poor performance of 0.6% nanofluid might well be higher stiffness as well as poor constancy [10].

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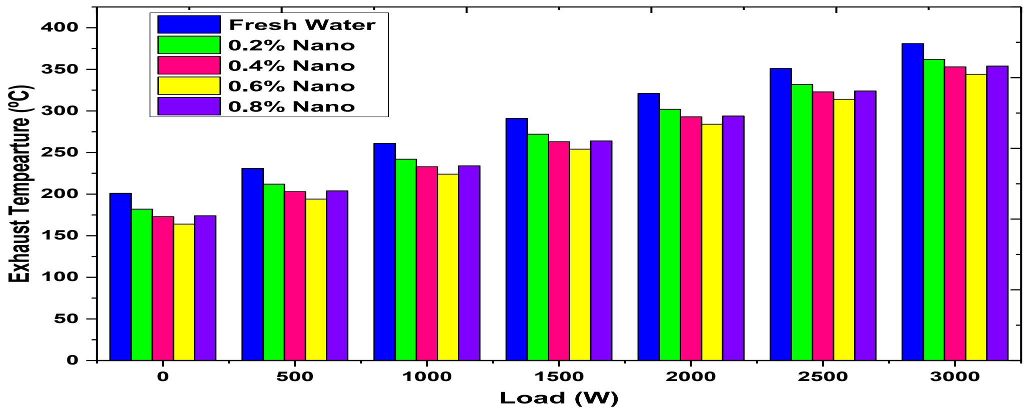

Fig.3. Exhaust temperature Vs Load under 280 LPH

3.3. Emission Conditions at mass flow rate 310 LPH

Figure 4 depicts the influence of different loading circumstances on heat release rate. At 0.2, 0.4, and 0.6% diffusion coefficients of nanofluids, respectively, the operating conditions temperature can be increased by 9-13%, 10-15%, and 10-16%. Furthermore, the reason for the maximum results of 0.4% volume fractions is that it is incredibly reliable as well as retains heat transfer for just a longer time frame than 0.2 and 0.4% weight percentages. As a result, the pretty reliable 0.4% particle volume fraction microspheres perform better in terms of air velocity. It has also been discovered that the degree of emission cooling medium increases loading. The minimal emission cooling effect occurs from 0 to 500 W of load, while the highest emission rate of cooling occurs around 1200 and 1800 W. That might be because the warmth drop ratio is faster at greater emission outputs [3,11].

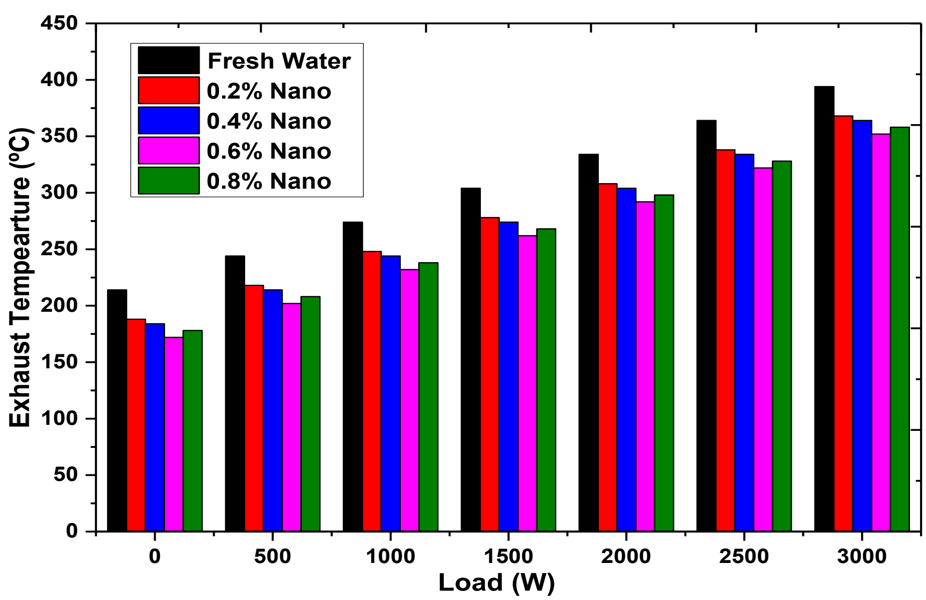

Fig.4. Exhaust temperature Vs Load under 310 LPH

CONCLUSION

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Throughout this research, particle concentrations of multi-walled carbon nanotube nanofluid of 0.2, 0.4, and 0.6% were synthesised, described, and evaluated in a multiple gasoline engine as cooling to evaluate the heat of the exhaust stream under various loads. Surfactants are used to test the durability of nanofluid. Hence the use of surfactants. These 0.4% nanomaterials are persistent, however, after 30 days of production. In comparison to freshwater, these nanofluid emission heat findings It has been discovered that at 0.4% particle volume fraction, the emission temperature decreases by 6-22%. This seems to be due to nanofluid having a greater thermal efficiency than seawater. At 360 LPH fluid velocity, when the loading is increased, the overall highest exhaust system heats are reduced by 10-16%. Throughout all flowrate academy settings, with 0.4% microspheres, combustion temperatures were substantially lower as well as at 1200 W–1800 W loading circumstances.

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